XEBEC SYSTEMS, INC.

XDF-50

DISK FORMATTER I/O SPECIFICATIONS

FOR

NOVA COMPUTER SERIES

Approved By: C. J. Hurst

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P/N: 300072

Revision: 01

REVISIONS

Rev. Level	Description	Approved	Date
00	Original Release	[signature]	10-11-72
01	p. 5 -- Add note concerning restore bit	[signature]	3-10-76

GENERAL

The Xebec coupler for interfacing the XDF-50 formatter to the Data General computer is designed to work with the complete Nova family. It is a single board that plugs into the computer mainframe (see Section 8 for detailed installation information).

The Xebec coupler requires no Data General options. It operates using the standard direct memory data channel.

Device assignment can be changed by jumpers on the coupler to any non-assigned pair from (0,1) to (76_8, 77_8). The coupler is normally shipped from Xebec with the jumpers set for devices (30, 31).

The interrupt mask bit can be set to any location 0-15. The coupler is shipped with this bit set to 5.

INPUT/OUTPUT CODE SUMMARY

(AC0 is used for purposes of illustration only.)

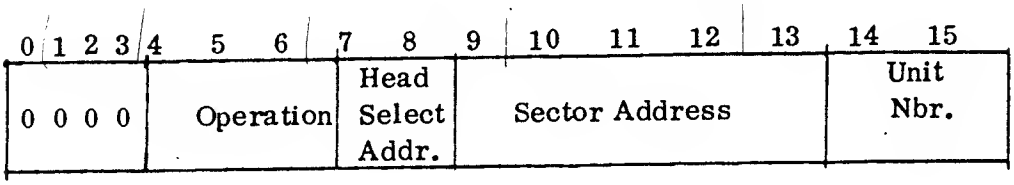
Symbolic		Octal	Operation
DOAS	0, 30	061130	OUTPUT COMMAND WORD
DOB	0, 30	062030	OUTPUT MEMORY ADDRESS
DOC	0, 30	063030	OUTPUT WORD COUNT (DMA Range)
DOC	0, 31	063031	OUTPUT CYLINDER ADDRESS
DICC	0, 30	062630	READ CONTROLLER STATUS
SKPDN	30	063630	SKIP IF DONE = 1
SKPDZ	30	063730	SKIP IF DONE = 0
SKPBN	30	063430	SKIP IF BUSY = 1
SKPBZ	30	063530	SKIP IF BUSY = 0
DOB	0, CPU	062077	ENABLE OR DISABLE DISK INTERRUPTS

DOAS 0,30
(061130)

OUTPUT COMMAND WORD

Loads the controller command register with the command in AC_{4-13} for the unit specified by AC_{14-15}. This instruction sets BUSY, resets DONE, and then initiates the specified operation. When the operation is completed, or when any error conditions occur, BUSY is cleared and DONE is set. This instruction must not be executed when BUSY is set.

AC



Bits

4-6 OPR Operation

000	=	No Operation
001	=	Write Preamble and a Sector
010	=	Check Preamble and Write a Sector
011	=	Check Preamble and Read a Sector
100	=	Read Diagnostic Mode
101	=	Check Preamble and Write a Sector, but Ignore Write Protect Bit in Preamble
110	=	Write Diagnostic Mode
111		

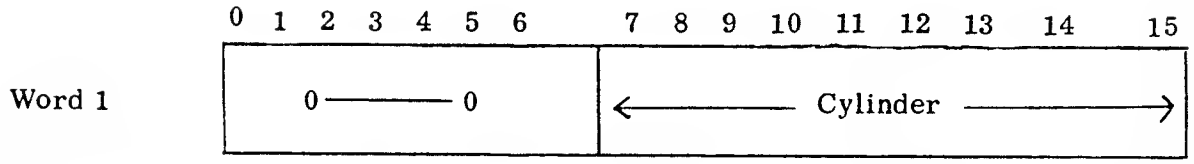
Bits		
7-8	Head	Head Select Address The head selected to be used for reading or writing is assigned as follows: 00 Upper Head - Removable Disk 01 Lower Head - Removable Disk 10 Upper Head - Fixed Disk 11 Lower Head - Fixed Disk
9-13	Sector	Sector Address Data transfer will occur on the sector specified by this 5-bit number. The acceptable range is from 0-S where: S is 37_8 for 32 sector disks 27_8 for 24 sector disks 17_8 for 16 sector disks 13_8 for 12 sector disks

14 - 15 Unit Unit Number

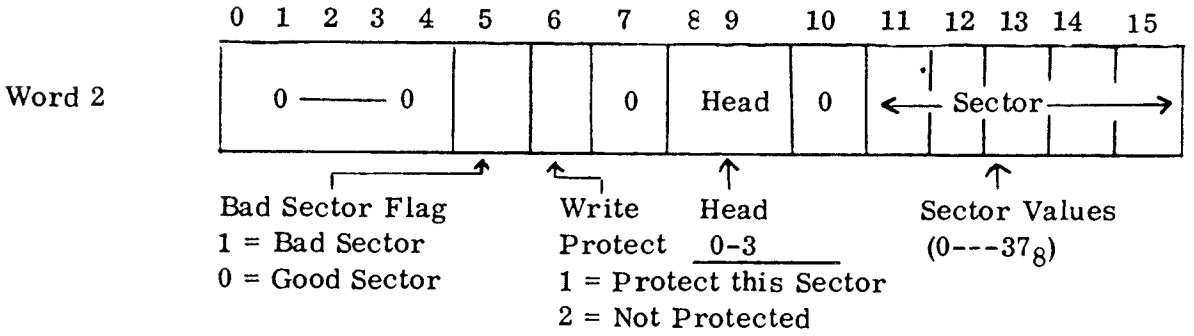
Unit selected for use by the controller.

Code	Selected Unit
00	0
01	1
10	2
11	3

TABLE I
PREAMBLE DATA FORMAT



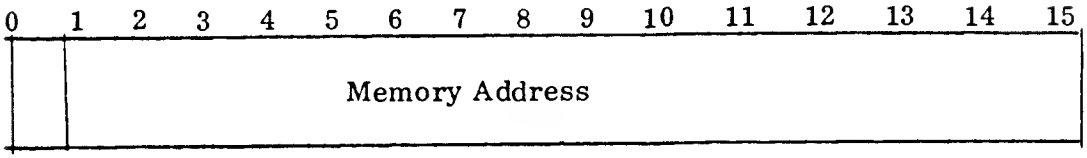
CYLINDER VALUES



DOB 0,30
(062030)

OUTPUT MEMORY ADDRESS

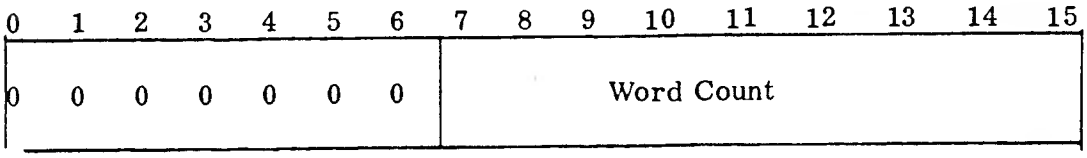
Loads the controller memory address register with the starting address for data transfers in AC_{0-15}. This instruction must not be executed when BUSY is set.



DOC 0,30
(063030)

OUTPUT WORD COUNT

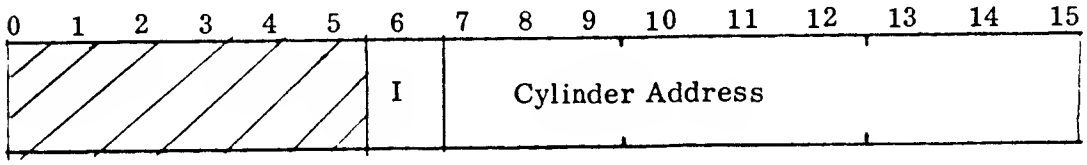
Loads the controller word count register with the number of words to be transferred in AC_{7-15}. BUSY and DONE are unchanged. This instruction must not be executed when BUSY is set.



DOC 0,31
(063031)

OUTPUT CYLINDER ADDRESS

Loads the cylinder address specified in AC_{7-15} into the cylinder address register. Initiates a SEEK on the last disk unit selected by a DOA. The cylinder address must lie in the range of $0\text{-}312_8$. If AC_6 is set, a guaranteed seek (restore) to cylinder 0 is initiated.



NOTE: If the restore bit is set, the remainder of the cylinder address word must be zeros.

After the SEEK has been initiated by the loading of this register, any other command (except SEEK) may be issued. Another SEEK cylinder command may be issued to a different disk unit within five (5) micro-seconds. This means that on a system which has more than one disk drive attached, the SEEK commands can be overlapped between drive units; i.e., two or more drive units may be seeking simultaneously while at the same time a data transfer is taking place on another disk unit.

If the drive unit number has been changed since a SEEK command was initiated, the cylinder address register must be reloaded before the data transfer command can be issued. This is necessary so that the cylinder address portion of the preamble compares correctly.

NOTE: The cylinder address register must not be loaded if BUSY = 1, or if the SEEK bit of the status word = 1.

DICC 0,30
(062630)

READ CONTROLLER STATUS

Loads AC $_{4-15}$ with the contents of the controller status register and clears DONE. The AC will contain the status of the last unit selected by a DOA instruction, and the current seek status of that unit. This instruction must not be executed when BUSY is set.

AC

0 1 2 3	4	5	6	7	8	9	10	11	12	13	14	15
0 0 0 0	NRDY	WPE	CAE	PCE	TMO	FTE	CRCE	RATE	BSEC	WCE	0	SEEK

Bits		
4	NRDY	Drive Not Ready The selected unit is not connected, not turned on or not up to speed.
5	WPE	Write Protect Error A write operation was attempted on a write protected sector or unit. No data transfer occurred.
6	CAE	Cylinder Address Error A cylinder address which exceeded the range of the selected drive unit was loaded into the cylinder address register. No data transfer occurred.
7	PCE	Preamble Check Error The cylinder or the sector portion of the preamble did not check. No data transfer occurred.
8	TMO	Time Out Error The unit did not go NOT BUSY. No data transfer occurred. This error is usually caused by selecting a sector number which does not exist on the selected drive unit.
9	FTE	Format Error No sync word was found in the specified sector. The disk is not formatted. No data transfer occurs.

10	CRCE	CRC Error The CRC word recorded at the end of the sector did not compare with the one calculated on the data in the sector. All specified data transfers occurred.
11	RATE	Rate Error The user did not clear the Data Flag within the specified length of time (by sending or accepting a new word). Data transfer occurred up through the end of the sector, but some words were missed.
12	BSEC	Bad Sector The Bad Sector Flag has been set to 1.
13	WCE	Word Count Error The word count was greater than zero at the completion of the operation. A full sector of data was transferred.
14		Not Used = 0
15	SEEK	Unit Seeking The disk unit last selected by a UNIT command is still executing a SEEK cylinder. If the user wishes to change the cylinder address on this unit, this bit must first to to zero.

SKPDN 30 (063630)

If DONE is set, skip the next instruction, otherwise, do not skip. This instruction can be executed at any time.

SKPDZ 30 (063730)

If DONE is not set, skip the next instruction, otherwise, do not skip. This instruction can be executed at any time.

DONE

DONE indicates that the disk has completed an operation and that the interrupts are armed; consequently, the disk has generated an interrupt.

The interrupt will occur only when the disk has completed its operation. An interrupt is not generated when the SEEK is complete.

SKP BN 30 (063430)

If BUSY is set, skip the next instruction, otherwise, do not skip. This instruction can be executed at any time.

SKPBZ 30 (063530)

If BUSY is not set, skip the next instruction, otherwise, do not skip. This instruction can be executed at any time.

BUSY

BUSY indicates that the controller is busy with an operation. If BUSY is true, no control words should be sent to the Formatter, and the status word may not be read. The only program controlled operation which may take place is aBUSY or DONE test.

DOB 0, CPU

Set up the Interrupt Disable Flags in the device according to the mask in AC (a 1 in a mask bit sets the flags assigned to that bit; a 0 clears the flags).

The disk may be assigned any position in the word, 0-15.

Command Sequence

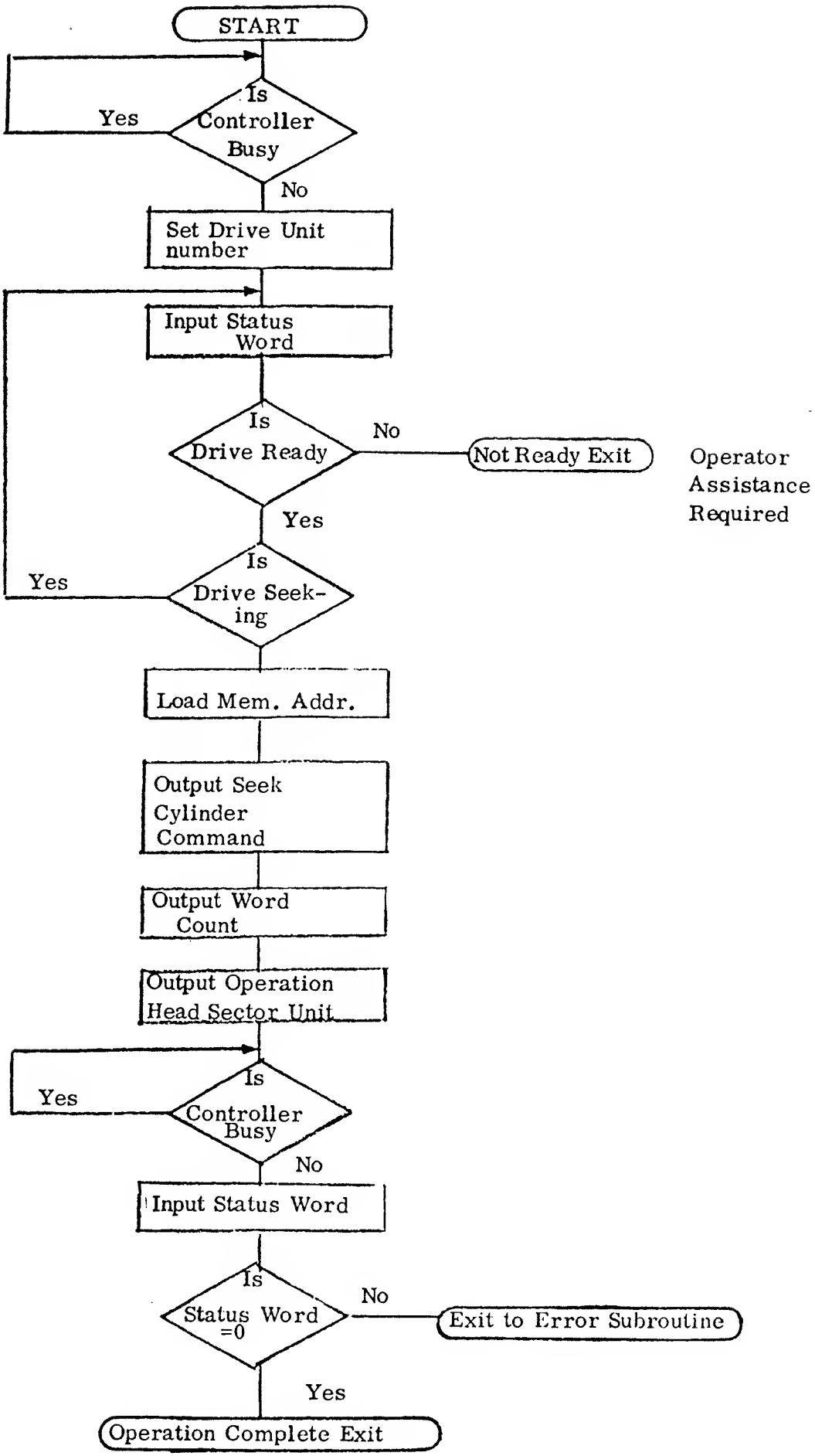
A typical command sequence is shown in the flow chart of Figure 1.

The only rules which must be followed are:

1) The Formatter must not be BUSY before any control word is transferred to the Formatter or the status word is read from the Formatter.

2) The selected unit must not be SEEKing when a new cylinder address is sent to the Formatter.

3) The command word causes the unit to go BUSY, and therefore must be the last control word sent to the Formatter if data transfer is specified.



COMMAND SEQUENCE FLOW CHART

	OPERATION	ACCEPTABLE WORD COUNT	ERROR WHICH TERMINATED OPERATION BEFORE DATA TRANSFER OCCURS	ERROR WHICH MAY OCCUR AFTER DATA TRANSFER	COMMENTS
000	No Operation	N.A.	NRDY, CAE	NONE	No operation is performed. BUSY goes off immediately, DONE is generated. This operation is used to change the unit number without performing a data transfer.
001	Write Preamble and 1 Sector	2-(N+2) Inclusive	NRDY, WPE, CAE, TMO	RATE, WCE, FTE	Writes preamble and data up to 1 sector in length depending upon value in word count register. The first two words transferred specify the preamble to be recorded as shown in Table II.
010	Check Preamble and Write 1 Sector	0 - N Inclusive	NRDY, WPE, CAE, PCE, BSEC, TMO, FTE	RATE, WCE	The previously recorded preamble is checked by the formatter, and data up to 1 sector in length is written on the disk. WC may be 0 - N inclusive. If WC is less than N, the remaining words in the sector are filled with zeroes.
011	Check Preamble and Read 1 Sector	0 - N+2	NRDY, CAE, PCE, BSEC, TMO, FTE	CRCE, RATE, WCE	The preamble previously recorded is checked by the formatter and data up to 1 sector in length is read from the disk. If WC is in the range 0 - N inclusive, WC words will be transferred. If WC is N + 1 or N + 2, the entire data portion of the sector is transferred plus the CRC word(s) will be input as the last word(s).
100	Read Diagnostic	N + 4	NRDY, CAE, TMO, FTE	CRCE, RATE, WCE	The preamble, 1 sector of data and the Cyclic Redundancy Check (CRC) words are read from the disk and transferred through the formatter. The preamble words are the first two words input followed by N data words followed by two CRC words.
101	Check Preamble and Write a Sector but Ignore Write Protect Bit in Preamble	0 - N	NRDY, WPE, CAE, PCE, BSEC, TMO, FTE	RATE, WCE	This operation is identical to 010 except the transfer is not terminated if the write protect bit in the preamble is set. If the write protect switch is on, or if the rest of the preamble does not check, writing will not occur.
110	Write Diagnostic	N + 4	NRDY, WPE, CAE, TMO, FTE	RATE, WCE	The preamble, 1 sector of data and the CRC words are transferred through the formatter and written on the disk. This instruction differs from 001 because the CRC words are transferred as data and are not generated by the formatter.
111	Ignore Preamble and Read a Sector	0 - N Inclusive	NRDY, CAE, TMO, FTE	CRCE, RATE, WCE	The preamble is not checked and up to 1 sector of data is read.